FFIR TEST FACILITY

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FFIR (Final Focus Interaction Region) test facility has been investigated for the second phase of the ATF (ATF-II) at KEK by ATF2 group. Goals of the facility are experimental verification of the novel final focus system with Raimondi/Seryi's optics and stabilization of focal point (FP) at nanometer level. Also a laser facility can be built in the neighborhood to deliver laser beam to the FP for collision with the electron beam, which is an optional PLC (Photon Linear Collider) test facility. The basic plan is described with possible schedule.

1 Introduction

One of most relevant features is nanometer focusing and stabilization at future linear colliders. First, the beams shall be focused by a final focus system, where the optical elements must be stabilized at sub-micron level. Secondly, the colliding two beams must be stabilized at nanometer level at the interaction point (IP). The tightest element is the final doublet which is built in the detector together with instrumentation for beam size and position measurements at nanometer level. For investigations of these important issues, FFIR test facility has been proposed as one of the ATF-II at KEK[1].

ATF (Accelerator Test Facility) has successfully produced the beams with the lowest emittance and multi-bunches[2,3] , where the beam energy is about 1.3GeV. These high quality beams would provide us opportunities for various test facilities of the novel final focus[4] , while the conventional system has been tested at FFTB/SLAC[5] , as well as the optional laser facility for photon linear colliders.

2 FFIR Test Facility

Schematic layout of the FFIR test facility is shown together with the optional PLC (Photon Linear Collider) test facility in Fig.1. The final focus system of 36.6m total length has been designed at downstream of the ATF extraction line[6] . The location is planned outside of ATF, where there is an activity of other research program at present. The PLC test facility can be placed at downstream of the focal point (FP). Figure 2 (a) shows the optics with L*=2m, where L* is a distance between the FP and the final quadrupole magnet. The

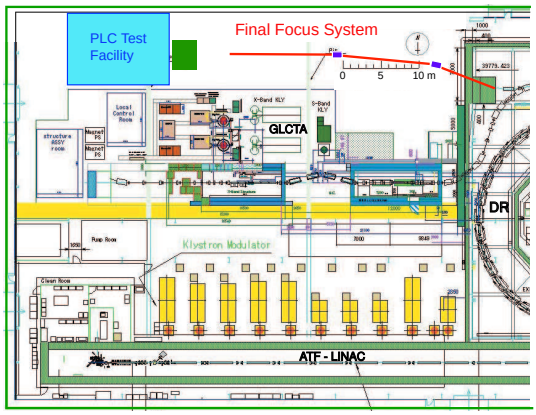

Figure 1: Layout of the FFIR test facility at ATF, KEK.

extracted beam is assumed to have 1.54 GeV energy, invariant emittance of $\gamma\varepsilon_x = 1\times10^{-6}$m with $\varepsilon_x/\varepsilon_y = 100/1$ and energy spread of $\delta = 0.1\%$ (Gaussian distribution). The beam sizes are expected to be σ_y^*=36.8nm and $\sigma_x^* = 3.42\mu$m with no error at FP by the SAD tracking simulation. Detailed investigation of the optics can be found in the reference[6] . Major characteristics of this novel optics is the local chromaticity ($\xi_{x(y)}$) correction with pairs of sextupole and quadrupole, i.e. SF2-QC2F and SD2-QC3F. Figure 2 (b) shows large chromaticity cancellations, especially in ξ_y, at the final doublet. Therefore, the most relevant feature shall be experimentally verified at the FFIR test facility. In addition, stability of the focused beam positions can be monitored and controlled with a cavity-type BPM (beam position monitor) at FP and an active mover at the final quadrupole. Since the cavity-BPM has position resolution at nanometer level in principle, the facility also shall demonstrate the nanometer stabilization at the final focus system.

3 PLC Test facility

As an option, a test facility is proposed for photon linear colliders (PLC). The PLC test facility consist of laser system, which generate laser beam with high intensity and multi-bunch structure similar to those at future photon linear colliders, and optical system to transport the laser beam to the FP for

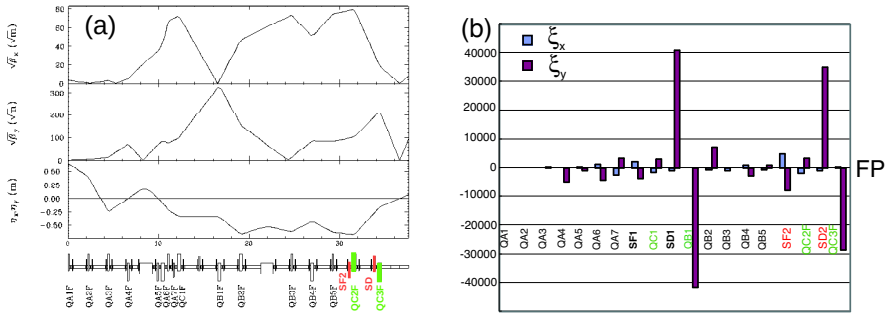

Figure 2: (a) Optics of final focus system at ATF2 and (b) chromaticity as each magnet.

collisions. Therefore, high energy photon beam is produced by back-scattering of laser beam with the focused beam at FP. Also, experiments can be conducted for test of QED in strong field of high intensity laser.

4 Conclusion

The FFIR test facility has been proposed for future linear colliders at ATF, KEK. The basic design has been completed, while a detailed investigation remains. The construction period has been estimated to be three years following that of the optional PLC facility. Also the total cost has been estimated to be several million dollars. We would like to realize the facility soon.

References

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